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EXAMINER	
HOGANS, DAVID L	

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2813	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/975,257	Applicant(s) NARAYANAN ET AL.
	Examiner David L. Hogans	Art Unit 2813

-- The MAILING DATE of this communication app ars on the cov r sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 26 August 2003 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-19 is/are pending in the application.

4a) Of the above claim(s) 20-22 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-19 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 12 October 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This Office Action is in response to Amendment A filed on August 26, 2003.

Status of Claims

Claims 1-19 are pending. Claims 20-22 are withdrawn.

Allowable Subject Matter

Claims 10 and 11, indicated as allowable subject matter in Paper No. 12, no longer meet the statutory requirements of 35 U.S.C. §§ 102 and 103. Therefore, Claims 10 and 11 are no longer allowable subject matter.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "predetermined" has been held to be indefinite. See *Seagram & Sons Inc. v. Mazall*, 180 F2d 26, 84 USPQ 180 (CA DC 1950). Also see *In re Rousso*, 106 USPQ 108 (CCPA 1955). The Examiner is uncertain if the "predetermined value" is referring to a thickness, a nitrogen content or something else.

3. Claims 7-11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claims 7-11 recite the limitation "the initial gate oxide thickness". There is insufficient antecedent basis for this limitation in the claim. Furthermore, the Examiner is uncertain if "the initial gate oxide thickness" refers to the thickness of the oxide layer before or after nitrogen has been incorporated into the layer.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 1, 3-7, 9-10 and 12 are rejected under 35 U.S.C. 102(a) as being anticipated by JP2000-311928 to Yasushi.

In reference to Claim 1, Yasushi teaches:

- oxidizing the nitrided gate oxide layer (3) on the substrate (1) (See Figures 1 and 2 and translation pages 1-2);
- measuring the thickness (L2) of the oxidized nitrided gate oxide layer (4) (See Figures 1 and 2 and translation pages 1-2);
- optionally calculating the change in thickness of the oxidized nitrided gate oxide layer (See Figures 1 and 2 and translation pages 1-2); and
- determining if the measured thickness or calculated change in thickness of

the oxidized nitrided gate oxide layer exceeds a predetermined value (i.e. - a 40 angstrom target thickness) (See Figures 1 and 2 and translation pages 1-2)

In reference to Claim 3, Yasushi teaches:

- further comprising correlating the measured thickness or change in thickness of the oxidized nitrided gate oxide layer with the nitrogen content of the gate oxide layer (See Figures 1 and 2 and translation pages 1-2)

In reference to Claim 4, Yasushi teaches:

- further comprising nitriding a gate oxide layer prior to the oxidizing step (See Figures 1 and 2 and translation pages 1-2)

In reference to Claim 5, Yasushi teaches:

- further comprising forming an initial oxide layer (2) on the substrate (1) prior to the nitriding step (See Figures 1 and 2 and translation pages 1-2)

In reference to Claim 6, Yasushi teaches:

- measuring the oxidized nitrided gate oxide thickness (L2) for a plurality of samples each having a known nitrogen content (See Figures 1 and 2 and translation pages 1-2);
- optionally calculating the change in thickness after oxidizing the nitrided

gate oxide layer for each sample (See Figures 1 and 2 and translation pages 1-2); and

- performing a least squares regression analysis to generate a calibration curve for nitrogen content of the nitrided gate oxide as a function of oxidized nitrided gate oxide thickness or change in oxidized nitrided gate oxide thickness (See Figures 1 and 2 and translation pages 1-2)

In reference to Claim 7 (as best understood), Yasushi teaches:

- wherein the step of determining the change in thickness of the oxidized nitrided gate oxide layer (L2) comprises determining the initial gate oxide thickness by measuring the thickness of the gate oxide layer prior to the oxidation step (L1) and calculating the difference between the measured oxidized nitrided gate oxide layer thickness and the initial gate oxide thickness (i.e. – [[L2-L1]/T]) (See Figures 1 and 2 and translation pages 1-2)

In reference to Claim 9 (as best understood), Yasushi teaches:

- wherein the initial gate oxide thickness is measured after the nitridation step (L1) (See Figures 1 and 2 and translation pages 1-2)

In reference to Claim 10 (as best understood), Yasushi teaches:

- oxidizing the nitrided gate oxide layer (3) on the substrate (1) (See Figures 1 and 2 and translation pages 1-2);

- measuring the thickness (L2) of the oxidized nitrided gate oxide layer (4) (See Figures 1 and 2 and translation pages 1-2);
- optionally calculating the change in thickness of the oxidized nitrided gate oxide layer (See Figures 1 and 2 and translation pages 1-2); and
- determining if the measured thickness or calculated change in thickness of the oxidized nitrided gate oxide layer exceeds a predetermined value (i.e. - a 40 angstrom target thickness) (See Figures 1 and 2 and translation pages 1-2)
- wherein the step of determining the change in thickness of the oxidized nitrided gate oxide layer (L2) comprises determining the initial gate oxide thickness by estimating the thickness of the gate oxide layer (L1) prior to the oxidation step and calculating the difference between the measured oxidized nitrided gate oxide layer thickness and the initial gate oxide thickness (i.e. – [[L2-L1]/T]) (See Figures 1 and 2 and translation pages 1-2)

The Examiner notes that the initial gate oxide thickness can be estimated by taking a measurement.

In reference to Claim 12, Yasushi teaches:

- measuring the concentration of nitrogen in a gate oxide layer (See Figures 1 and 2 and translation pages 1-2)

Although Yasushi fails to explicitly teach the formation of a gate electrode layer, the Examiner deems the formation of a gate electrode layer as inherent to the disclosure of Yasushi because the scope of Yasushi entails a judgment method for nitrogen concentration in a gate oxide film. See MPEP § 2112

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP2000-311928 to Yasushi.

Claim 8

Incorporating all arguments of Claims 1 and 7 and noting that Yasushi fails to explicitly teach wherein the initial gate oxide thickness is measured before the nitridation step. Noting that Yasushi does teach measuring the gate oxide thickness after the nitridation step.

However, the specification contains no disclosure of either the critical nature of the claimed process (i.e. - measuring the gate oxide thickness before the nitridation step) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the Applicant must show that the chosen limitations are critical. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990)

In light of Applicant's failure to establish criticality, the limitation of measuring the gate oxide thickness before the nitridation step is deemed equivalent to the limitation of measuring the gate oxide thickness after the nitridation step.

Claim 11

Incorporating all arguments of Claims 1 and 10 and noting that Yasushi fails to explicitly teach wherein the initial gate oxide thickness is estimated from previously collected gate oxide thickness data.

However, the specification contains no disclosure of either the critical nature of the claimed process (i.e. - estimating the gate oxide thickness from previously collected gate oxide thickness data) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the Applicant must show that the chosen limitations are critical. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990)

In light of Applicant's failure to establish criticality, the limitation of estimating the gate oxide thickness from previously collected gate oxide thickness data is deemed equivalent to estimating the gate oxide thickness via measurement.

5. Claims 2 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP2000-311928 to Yasushi in view of Silicon Processing for the VLSI Era (Volumes 1-3) to Wolf et al.

Claim 2

Incorporating all arguments of Claim 1 and noting that Yasushi fails to explicitly teach thermal oxidation of the nitrided gate oxide layer by rapid thermal processing.

However, Wolf et al., on page 310 (vol. 1), teaches that RTP is emerging as the tool of choice for growth of ultra thin gate oxides and oxynitrides. Furthermore, Wolf et al. teaches that RTP allows for reduced thermal budget, higher temperature processing, improved gas distribution and better control of process ambient.

It would have been obvious to one of ordinary skill in the art to modify Yasushi by incorporating growth of oxides and oxynitrides via RTP, as taught by Wolf et al., to reduce thermal budgets, operate at higher temperatures for processing, improve gas distribution and provide better control of process ambient.

Claim 14

Incorporating all arguments of Claims 1 and 12 and noting that Yasushi fails to explicitly teach equating the predetermined value to a sufficient nitrogen content to prevent boron atoms from diffusing.

However, Wolf et al., on pages 313 and 649 (vol. 3), teaches that a gate oxide subjected to nitridation will provide a barrier to boron migration. The Examiner notes

that it is well known within the art to selectively dope an oxide layer with a specified nitrogen concentration to prevent boron diffusion.

It would have been obvious to one of ordinary skill in the art to modify Yasushi by incorporating a gate oxide subjected to nitridation that will provide a barrier to boron migration, as taught by Wolf et al., because it is well known within the art to selectively dope an oxide layer with a specified nitrogen concentration to prevent boron diffusion.

Claims 15 and 16

Incorporating all arguments of Claim 1 and noting that Yasushi fails to explicitly teach wherein the oxidation step is conducted at a temperature of 900 to 1025 °C and for 10 minutes or less.

However, Wolf et al., on page 653 (vol. 3), teaches reoxidation of a nitrided gate oxide layer at a temperature of 950 to 1150 °C for about 60 seconds. Furthermore, Wolf et al. teaches that these are common process conditions for the reoxidation of a nitrided oxide layer.

It would have been obvious to one of ordinary skill in the art to modify Yasushi by incorporating the reoxidation of a nitrided gate oxide layer at a temperature of 950 to 1150 °C for about 60 seconds, as taught by Wolf et al., because these are the process conditions commonly employed to create such a layer.

Claims 17 and 18

Incorporating all arguments of Claims 1 and 4 and noting that Yasushi, in pages 1-2 of the translation, teaches performing the oxidation and nitridation steps in the same chamber but fails to explicitly teach wherein the oxidation step and nitridation step are performed in different tools.

However, the Examiner deems performing the oxidation and nitridation steps in the same chamber as equivalent to performing oxidation and nitridation in different tools because the end results are the same. Further the specification contains no disclosure of either the critical nature of the claimed process or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the Applicant must show that the chosen limitations are critical. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990)

6. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP2000-311928 to Yasushi in view of Silicon Processing for the VLSI Era (Volumes 1-3) to Wolf et al. further in view of Semiconductor Manufacturing Technology to Quirk et al.

Incorporating all arguments of Claims 1 and 12 and noting that Yasushi fails to explicitly teach implanting boron atoms into a gate electrode.

However, Quirk et al., on page 477, teaches a polysilicon electrode doped with boron. Furthermore, Quirk et al. teaches that one would dope the polysilicon electrode to make it conductive.

It would have been obvious to one of ordinary skill in the art to modify Yasushi by incorporating a polysilicon electrode doped with boron, as taught by Quirk et al., to make the electrode conductive.

7. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over 5,862,054 to Li in view of JP2000-311928 to Yasushi.

Li teaches: collecting process parameter data for each batch (30); storing parameter data in a data base (32); computing an average value for each stored parameter (32); storing the average values in a historical data file on a computer (33); determining process control limits from the stored historical data file (34); and monitoring the process parameters and comparing these values to control limits. (See Figure 3 and column 4 lines 1-20) Li also inherently teaches that any of the above steps can be repeated to obtain necessary data for statistical process control.

Li fails to explicitly teach measuring the thickness of an oxidized nitrided gate oxide layer for each substrate in a batch.

However, Yasushi, in Figures 1 and 2 and pages 1-2 of the translation, teaches measuring the thickness of an oxidized nitrided gate oxide layer for each substrate in a batch to correlate the reoxidized layers thickness with the nitrogen content of the nitrided gate oxide. Yasushi teaches that one would correlate these two parameters to determine the nitrogen concentration.

It would have been obvious to one of ordinary skill in the art to modify Li by incorporating measuring the thickness of an oxidized nitrided gate oxide layer for each substrate in a batch to correlate the reoxidized layers thickness with the nitrogen content of the nitrided gate oxide, as taught by Yasushi, to determine the nitrogen concentration.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-6, 12 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over 6,528,433 to Gartner et al. in view of Silicon Processing for the VLSI Era (Volumes 1-3) to Wolf et al.

Claim 1

Gartner et al. teaches: oxidizing an oxynitride layer on a substrate (See column 3 lines 22-50); measuring the thickness of the oxidized oxynitirde layer (4) by calculating the change in thickness of the oxidized oxynitride layer by ellipsometry (See column 3 lines 32-60); and determining if the calculated change in thickness (around 25 nm) of the oxidized oxynitride layer (4) exceeds a predetermined value of 30 nm (the thickness of the oxide layer had the substrate not contained nitrogen) (See column 3 lines 32-60).

Gartner et al. fails to explicitly teach wherein the oxidized layer is a nitrided gate oxide.

However, Wolf et al., on page 649 (vol. 3), teaches a nitrided gate oxide that is reoxidized. Furthermore, Wolf et al. teaches that one would reoxidize the nitrided gate oxide to reduce the density of electron traps.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating a nitrided gate oxide that is reoxidized, as taught by Wolf et al., to reduce the density of electron traps.

Claim 2

Incorporating all arguments of Claim 1 and noting that Gartner et al. fails to explicitly teach thermal oxidation of the nitrided gate oxide layer by rapid thermal processing.

However, Wolf et al., on page 310 (vol. 1), teaches that RTP is emerging as the tool of choice for growth of ultra thin gate oxides and oxynitrides. Furthermore, Wolf et al. teaches that RTP allows for reduced thermal budget, higher temperature processing, improved gas distribution and better control of process ambient.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating growth of oxides and oxynitrides via RTP, as taught by Wolf et al., to reduce thermal budgets, operate at higher temperatures for processing, improve gas distribution and provide better control of process ambient.

Claim 3

Incorporating all arguments of Claim 1 and noting that Gartner et al. teaches correlating the change in thickness of the oxidized nitrided gate oxide layer with the nitrogen content of the gate oxide layer (See columns 3-4 lines 50-02 and Figure 4)

Claim 4

Incorporating all arguments of Claim 1 and noting that Gartner et al. fails to explicitly teach nitriding a gate oxide layer prior to the oxidizing step.

However, Wolf et al., on pages 649-654 (vol. 3), teaches nitriding a gate oxide layer prior to the oxidizing step. Furthermore, Wolf et al. teaches that one would

nitride a gate oxide to provide a barrier to various dopants and contaminants (i.e. – boron).

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating a nitrided gate oxide, as taught by Wolf et al., to provide a barrier to various dopants and contaminants (i.e. – boron).

Claim 5

Incorporating all arguments of Claim 1 and noting that Gartner et al. fails to explicitly teach forming an initial oxide layer on the substrate prior to the nitriding step.

However, Wolf et al., on pages 299-300 (vol. 1), teaches forming a nitrided oxide layer by forming an initial oxide layer on the substrate and then annealing that layer in either ammonia, nitrous oxide or nitric oxide. Furthermore, Wolf et al. teaches that this method is one of the two main ways of forming a nitrided oxide layer.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating the formation of a nitrided oxide layer by creating an initial oxide layer on the substrate and then annealing that layer in either ammonia, nitrous oxide or nitric oxide, as taught by Wolf et al., because it is one of the two main ways of forming a nitrided oxide layer.

Claim 6

Incorporating all arguments of Claim 1 and noting that Gartner et al. teaches: measuring the oxidized nitrided layer for a test wafer as well as additional production wafers with a known nitrogen content (See column 3 lines 15-60); calculating the change in thickness after oxidation of the nitrided layer for each sample (See column 3 lines 33-60); and performing a least squares regression analysis to generate a calibration curve for nitrogen content as a function of the change in the oxidized nitrided layers thickness (See column 3 lines 15-60 and Figure 4).

Claim 12

Incorporating all arguments of Claim 1 and noting that Gartner et al. fails to explicitly teach forming a gate electrode over the gate oxide layer.

However, Wolf et al., on pages 313 and 649 (vol. 3), teaches forming a reoxidized nitrided gate oxide layer as part of a MOSFET configuration. Furthermore, Wolf et al. teaches that a reoxidized nitrided gate oxide layer can prevent diffusion of boron in a MOSFET configuration.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating the formation of a gate electrode over the gate oxide layer, as taught by Wolf et al., to prevent diffusion of boron in a MOSFET configuration.

Claim 14

Incorporating all arguments of Claims 1 and 12 and noting that Gartner et al. fails to explicitly teach equating the predetermined value to a sufficient nitrogen content to prevent boron atoms from diffusing.

However, Wolf et al., on pages 313 and 649 (vol. 3), teaches that a gate oxide subjected to nitridation will provide a barrier to boron migration. The Examiner notes that it is well known within the art to selectively dope an oxide layer with a specified nitrogen concentration to prevent boron diffusion.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating a gate oxide subjected to nitridation that will provide a barrier to boron migration, as taught by Wolf et al., because it is well known within the art to selectively dope an oxide layer with a specified nitrogen concentration to prevent boron diffusion.

Claims 15 and 16

Incorporating all arguments of Claim 1 and noting that Gartner et al. fails to explicitly teach wherein the oxidation step is conducted at a temperature of 900 to 1025 °C and for 10 minutes or less.

However, Wolf et al., on page 653 (vol. 3), teaches reoxidation of a nitrided gate oxide layer at a temperature of 950 to 1150 °C for about 60 seconds. Furthermore, Wolf et al. teaches that these are common process conditions for the reoxidation of a nitrided oxide layer.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating the reoxidation of a nitrided gate oxide layer at a temperature of 950 to 1150 °C for about 60 seconds, as taught by Wolf et al., because these are the process conditions commonly employed to create such a layer.

Claims 17 and 18

Incorporating all arguments of Claims 1 and 4 and noting that Gartner et al., in column 3 lines 15-60, teaches wherein the oxidation step is performed in the same tool as the nitridation step but fails to explicitly teach wherein the oxidation step and nitridation step are performed in different tools.

However, the Examiner deems performing oxidation in the same tool as the nitridation step as equivalent to performing oxidation and nitridation in different tools because the end results are the same. Further the specification contains no disclosure of either the critical nature of the claimed process or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or

upon another variable recited in a claim, the Applicant must show that the chosen limitations are critical. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990)

3. Claims 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over 6,528,433 to Gartner et al. in view of Silicon Processing for the VLSI Era (Volumes 1-3) to Wolf et al. in view of 5,904,523 to Feldman et al.

Claims 7 and 9

Incorporating all arguments of Claim 1 and noting that Gartner et al. fails to explicitly teach measuring the change in thickness of the oxidized nitrided gate oxide layer by measuring the thickness of the gate oxide layer prior to oxidation and measuring the reoxidized nitrided gate oxide layer after oxidation.

However, Feldman et al., in column 7 lines 20-30, teaches measuring the nitrided layer before oxidation and after oxidation. Furthermore, it is inherent that Feldman et al. performed the above technique so as to determine the thickness of the reoxidized layer, as the dimensions of transistor components is of an ever increasing importance in the fabrication of semiconductor devices.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. by incorporating measuring the nitrided layer before oxidation and after oxidation, as taught by Feldman et al., to determine the thickness of the reoxidized layer.

Claim 8

Incorporating all arguments of Claims 1 and 7 and noting that the Examiner deems the measuring of the gate oxide thickness after the nitridation step as equivalent to measuring of the gate oxide thickness before the nitridation step. Further the specification contains no disclosure of either the critical nature of the claimed process or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the Applicant must show that the chosen limitations are critical. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990)

4. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over 6,528,433 to Gartner et al. in view of Silicon Processing for the VLSI Era (Volumes 1-3) to Wolf et al. further in view of Semiconductor Manufacturing Technology to Quirk et al.

Incorporating all arguments of Claims 1 and 12 and noting that Gartner et al. and Wolf et al. fail to explicitly teach implanting boron atoms into a gate electrode.

However, Quirk et al., on page 477, teaches a polysilicon electrode doped with boron. Furthermore, Quirk et al. teaches that one would dope the polysilicon electrode to make it conductive.

It would have been obvious to one of ordinary skill in the art to modify Gartner et al. and Wolf et al. by incorporating a polysilicon electrode doped with boron, as taught by Quirk et al., to make the electrode conductive.

5. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over 5,862,054 to Li in view of 6,528,433 to Gartner et al. in view of Silicon Processing for the VLSI Era (Volumes 1-3) to Wolf et al.

Claim 19

Li teaches: collecting process parameter data for each batch (30); storing parameter data in a data base (32); computing an average value for each stored parameter (32); storing the average values in a historical data file on a computer (33); determining process control limits from the stored historical data file (34); and monitoring the process parameters and comparing these values to control limits. (See Figure 3 and column 4 lines 1-20) Li also inherently teaches that any of the above steps can be repeated to obtain necessary data for statistical process control.

Li fails to explicitly teach measuring the thickness of an oxidized nitrided gate oxide layer for each substrate in a batch.

However, Gartner et al. and Wolf et al. (see Claim 1), teach measuring the thickness of an oxidized nitrided gate oxide layer for each substrate in a batch to

correlate the reoxidized layers thickness with the nitrogen content of the nitrided gate oxide. Gartner et al., in column 2 lines 19-30 and column 4 lines 1-11, teaches that one would correlate these two parameters to determine the quality of the nitrogen process (i.e. – to measure the nitrogen content).

It would have been obvious to one of ordinary skill in the art to modify Li by incorporating measuring the thickness of an oxidized nitrided gate oxide layer for each substrate in a batch to correlate the reoxidized layers thickness with the nitrogen content of the nitrided gate oxide, as taught by Gartner et al. and Wolf et al., to determine the quality of the nitrogen process (i.e. – to measure the nitrogen content).

Response to Arguments

6. Applicant's arguments filed August 26, 2003, in Paper No 14, have been fully considered but they are not persuasive.

7. Applicant traversed the Rejection of Paper No. 12 by arguing the merits of Claim 1. The crux of Applicant's argument was that Wolf et al. teaches away from combination with Gartner et al. because Wolf et al. discloses that the thickness of the nitrided film would remain basically unchanged during the reoxidation step. The Examiner deems this argument without merit because Wolf et al. was not cited for a change in thickness of a nitride layer during a reoxidation step. Wolf et al. was merely cited to show that it is well known within the art that nitrided gate oxide layers are reoxidized. Furthermore, Wolf et al. taught that nitrided gate oxide layers are reoxidized

so as to reduce the density of electron traps which affect a transistors performance. Finally, the Examiner notes that Gartner et al. taught that reoxidized oxynitride layers exhibit an increase in thickness when confronted with thermal oxidation and, as such, Wolf et al. need not teach this limitation.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David L. Hogans whose telephone number is (703) 305-3361. The examiner can normally be reached on M-F (7:30-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1782.

dh DH
November 4, 2003

Carl Whitehead Jr.
CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
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